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Applicant TEIJIN LIMITED

## SPECIFICATION

Title: HEAT-RESISTANT PROTECTIVE GARMENT

## Scope of Claim for Patent

[Claim 1] A heat-resistant protective garment having a composite structure consisting of a front ply, an intermediate ply and a heat barrier ply, wherein the front ply, the intermediate ply and the heat barrier ply respectively satisfy the requirements set out below:

(a) the front ply is constituted from meta-aramid fibers and para-aramid fibers;

(b) the intermediate ply is moisture-permeable and water-proof; and

(c) the heat barrier ply is formed from a composite of a nonwoven meta-aramid fiber fabric with a woven meta-aramid fiber fabric.

[Claim 2] The heat-resistant protective garment as

claimed in claim 1, wherein para-aramid fibers in the front ply are present in a mixing proportion in the range of from 5 to 50%, based on the total mass of the fibers from which the front ply is constituted.

[Claim 3] The heat-resistant protective garment as claimed in claim 1 or 2, wherein an inorganic compound is carried on the front ply.

[Claim 4] The heat-resistant protective garment as claimed in claim 3, wherein the inorganic compound is an oxide or an oxide complex of at least one metal member selected from the group consisting of silicon, aluminum, zinc, zirconium, iron, antimony and magnesium.

[Claim 5] The heat-resistant protective garment as claimed in any one of claims 1 to 4, wherein the front ply has been water repellent-treated.

[Claim 6] The heat-resistant protective garment as claimed in any one of claims 1 to 5, wherein the intermediate ply is formed from woven meta-aramid fiber fabric laminated with a polytetrafluoroethylene film.

[Claim 7] The heat-resistant protective garment as claimed in any one of claims 1 to 6, wherein the heat barrier ply is constituted from a composite fabric in which a nonwoven meta-aramid fiber fabric and a woven meta-aramid fiber fabric are bonded together by a quilting procedure.

[Claim 8] The heat-resistant protective garment as claimed in any one of claims 1 to 7, wherein the heat

barrier ply contains expanding agent consisting of heat-expansible hollow particles formed from an organic polymer.

[Claim 9] The heat-resistant protective garment as claimed in claim 8, wherein the organic polymer from which the hollow particles are formed is an acrylonitrile polymer or a copolymer of acrylonitrile with vinylidene chloride.

[Claim 10] The heat-resistant protective garment as claimed in claim 8, wherein a gas contained in the hollow particles is isobutene gas.

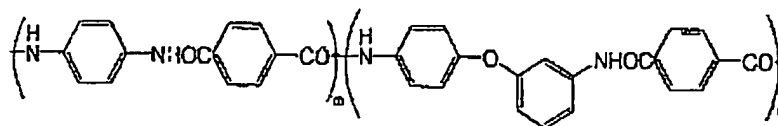
[Claim 11] The heat-resistant protective garment as claimed in claim 7 or 8, wherein the nonwoven meta-aramid fiber fabric from which the heat barrier ply is formed has a basis mass of 20 to 200 g/m<sup>2</sup>.

#### Passage 1

--[0008] For the aramide fibers used in the present invention, poly-metaphenyleneisophthalamide having a high LOI value is used in practice. For the purpose of enhancing the mechanical strength of the resultant woven fabric, para-aramid fibers such as poly-paraphenyleneterephthalamide fibers or fibers of copolymer of this polymer with an additional (third) component are preferably blended with the meta-aramide fibers. As an example of the poly-paraphenyleneterephthalate copolymer, copoly-paraphenylene-3,4'-oxydiphenyleneterephthalamide represented by the following formula can be used.

[0009]

[Chem. 1]



## Passage 2

--[0010] The front ply which constitutes one of the above-mentioned three-ply structure is constituted from a fabric consisting of meta-aramid fibers and para-aramid fibers. The fabric may be a woven or knitted fabric or a nonwoven fabric. Preferably, the woven fabric having high mechanical strength is used.

[0011] Also, in an example, the meta-aramid fibers and the para-aramid fibers are preferably employed in the form of a blended fiber yarn. The content of the para-aramid fibers in the blended fiber yarn is preferably 5% by mass or more and 50% by mass or less, based on the total mass of the fibers from which the front ply is constituted. When the content of the para-aramid fibers is less than 5% by mass, the resultant ply may have insufficient mechanical strength, and when it is more than 50% by mass, the para-aramid fibers may easily fibrillated and may be unpractical.

## Passage 3

[0027] The heat-resistant protective garment has a composite structure formed from a front ply, an intermediate ply and a heat barrier ply. These plies are not necessary to be bonded to each other. They may be superposed on each other and sewed together.

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# HEAT-RESISTANT PROTECTIVE CLOTHING

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## Abstract of JP2000212810

**PROBLEM TO BE SOLVED:** To provide a heat-resistant protective clothing free from the problems of conventional protective clothing, having excellent chemical resistance and waterproofness, effectively forming an air layer to improve the heat-insulation without remarkably increasing the weight, imparted with moisture-permeability to improve the wearing comfortableness and having light weight and soft texture. **SOLUTION:** This protective clothing has a composite structure composed of an outer layer, an intermediate layer and a heat-insulation layer satisfying the following requirements at the same time. (a) The outer layer is composed of a meta-type aramid fiber and a para-type aramid fiber, (b) the intermediate layer has moisture-permeable waterproofing property and (c) the heat-insulation layer is a composite material composed of a nonwoven fabric of a meta-type aramid fiber and a woven fabric of a meta-type aramid fiber.